Whose Agroforestry Product it is? Crossing Kinship and Tenure Rights theories to Analyze Agroforestry Systems

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Abstract

Social and economical importance of the products derived from the perennial crop Agroforestry systems is well recognized by researchers, chains supply operators and policy makers. Although there have been many studies on economical values on tree products very few of them have analyzed the access rights of them.

From research of twenty years, in particular in six countries: the Comoros, Cameroon, Madagascar, Benin, Ivory Coast and Indonesia, this article analyze the importance of the link between the status of the products, the management of the trees and the products and their values: agronomic, economic and symbolic systems.

One of the major advantages of the Agroforestry systems is their multi-functionality. It is interesting to use the multiple potential of the trees which provide, at the same time, products and services. It increases the chance to stimulate the development of sustainable systems combining environmental services and economic values.

For the multipurpose character of the trees induces the multi-appropriation of the products, we propose to use tools of socio-anthropology to analyze the rights of access to the Agroforestry products.

Firstly, we will examine the characteristics and functions of the perennial crops and their products. Beyond the functions of productions, the trees are a physical support of the economic and social accumulation of the households because of their perennial character. This specificity makes it possible to the actors to satisfy, via the trees, their patrimonial needs of any type: inheritance of treasury, inheritance of precaution, inheritance dedicated to events, inheritance related to the cycle of life and inheritance of transmission.

Secondly, we will identify the main objectives of the rural families by using the contributions of the agrarian systemic analysis in particular with the use of the concept "family-farming system". The use of the anthropological concept and methods of kinship makes it possible to identify the production, consumption, accumulation or residence units of the families which are seldom superposed. The objectives and the strategies can thus be analyzed in their complexity even their contradictions inside the same family or for the same individual. Thus the multiple decision-making centers are analyzed and can be taken into account for development projects.

Thirdly, it is common to admit that the property of the land gives the property of the trees of this land and consequently the rights of access to these trees and their products. But specialists in land (economists, socio-anthropologists, lawyers, etc.) showed that it is necessary to dissociate the status of the resources and the status of the land. The tenure rights theory makes it possible to identify and analyze the variety of the rights concerning the space, the tree and its products. The major tool of this theory is a matrix which models the rights in five categories by combining the physical rights of access, extraction, management, exclusion and alienation.

Combining the use of the tools of the system approach, those of kinship and the use of the matrix of the land controls, we can identify and analyze the stakes related to the access rights of the trees and their products in economic and social terms. The recognition of the diversity of the production functions and of the patrimonial functions helps the development projects to

better answer the multiple objectives of the stakeholders, in particular via the Agroforestry systems which offer, from their perennial and various natures, major assets.

Key words: Agroforestry, kinship, access rights, land tenure, tree tenure, inheritance, economic and social functions.

Introduction

Although there have been many studies on economical values on tree products very few of them have analyzed the access rights of them.
It is necessary to wonder about the status of the trees and their products. Extension services, partnership with local stakeholders in an Agroforestry program should organize in different way according to the access rights to the land, to the trees and their products. The situations are often complex. Some products of the same tree can be common goods (humus, deadwood, medicinal products) whereas others are private goods (fodder, fruits).
One of the major advantages of the Agroforestry systems is their multifonctionality. It is interesting to use the multiple potential of the trees which provide at the same time products and services. It increases the chance to stimulate the development of sustainable systems combining environmental services and economic values.
The multipurpose character of the trees induces multibelonging for their products.
This can be another advantage or on contrary a disadvantage according to types of the products, social rules and markets
From research of twenty years, in particular in six countries: the Comoros, Cameroon, Madagascar, Benin, Ivory Coast and Indonesia, this article analyze the importance of the link between the status of the products, the management of the trees and the products and their values: agronomic, economic and symbolic systems.
We suggest using concepts and tools of socio-anthropology to understand better what the rights of access to the Agroforestry products are.
Trees belonging to multistrata Agroforestry systems are mostly Farmers' trees. Anyway, we will deal here with this case of trees. We will examine Agroforestry examples more largely than those containing agricultural perennial cultures in the case we think that the example used is relevant also for perennial crops.
Firstly, we will examine the characteristics and functions of the perennial crops and their products. Secondly, we will identify the main objectives of the rural families by using the contributions of the agrarian systemic analysis and the concept and methods of kinship. Thirdly, the tenure rights theory makes it possible to identify and analyze the variety of the rights concerning the space, the tree and its products. And combining the use of these tools, we can identify and analyze the stakes related to the access rights of the trees and their products in economic and social terms.

Material and methods

Characteristics and functions of the perennial plants and their products

Characteristics

Tree supplies can be divided in four categories: products, services, the material inheritance and the cultural inheritance. The Agroforestry products are collected and exported whereas services are used on the spot. These services are related to the presence of the plant either immediately (ex. shade) or in a postponed time (ex. fertility).
The tree products are very varied: timber, firewood, food, fodder, medicines, craft material, resin, gum, essential oils, etc. Farmers can consume these products or sell them for getting cash. In this case, the production is mostly dependant on the demand –pull of the supply

chains. The services provided by Agroforestry Systems, especially because of the presence of the trees are numerous: shade, fight against soil erosion, fences and protection against the animals and the crop theft, windbreaks, improving fertility soil, microclimat… These services are not transportable. They are not in general the object of commercial exchanges.

Often, in rural area, the trees are also part of the individual, family or village inheritance. The long-term objectives, therefore concerning patrimonial objectives as scheduling the retirement or the future generations, determine the strategies of plantation, management and exploitation of the trees.

The rural tree has also social and symbolic functions. On the one hand, as a visible and perennial element in landscape, it is a mark ; on the other hand, as sheltering invisible pantheon, it is a signature (Lauga Sallenave and Sibelet, 1998; Lauga-Sallenave, 1996). As land marker or as ancestors' dwelling place, the tree counts in the relations between people. It affirms and limits the property in front of the neighbors. It symbolizes the membership to a family, a lineage or a clan.

The products and the services can be merchants or not. This second option is the case of the products when they are self-consumed or exchanged. Most of the time, the services are, from their non-transportable nature, not merchants: examples, shade, fight against soil erosion, windbreaks.

The harvesting technique depends on the farmer‘s knowledge and practices, on the access rules to the products, on the market and on the remuneration of the products.

For instance, the cut of the tree to obtain fodder can be light or heavy (trimming, pruning, topping). In Nétéboulou Region in east Senegal, the way of cutting fodder depend on the rights access the various ethnic groups have, on the animal density per hectare, on the distance to the village and on the food shortage time (Gandon, 2003).

The harvesting technique can contribute to the development of the tree or put it in danger. A severe cut of the tree, even radical, does not always damage the tree. It is sometimes necessary. For example, the topping of *Faidherbia Albida* (Manlay et al., 2004) shorten trees which became so big and so sensitive to the wind that they could break or fall. And by the way, this topping allows obtaining fodder. For some species (coffee trees, lychee trees (*Litchi chinensis*), mango trees…), and in some cases, ratooning is necessary for rejuvenating trees or for grafting.

The delay the trees need to first produce depends:

(i) on the plant material and the natural environment of the tree and (ii) on the techniques used.

(ii) varieties, plasticity plant, climatic and soils conditions

(iii) plantation techniques and management : macro-cutting, grafting, irrigation, protection against the competition of the associated crops

The tree products are more or less seasonal. First, the production can spread from a few weeks (mostly fruit) to the whole year (fodder, craft material, medicines). Second, products must be harvested at once (most of the fruit) or can wait on the tree several days (coffee) or several years (ex. wood, bark).

The Agroforestry production presents irregularity and uncertainty.

The irregularity of the annual production is mostly due to the tree phenology especially, in some cases, to its alternative bearing characteristic.

The uncertainty of the production is due to the climatic variations, predatory, diseases.

The tree as a capital is more or less strong according to the risks of mortality, to value or price fall, and to premature end of production.

Economic and social functions: production and accumulation

The villagers use and modify the characteristics of the plants and their products to allocate specific economic and social functions to them: consumption functions or patrimonial functions.

On the family and farming system level, the first function is related to production. It is declined in (i) production for the family self-consumption (ii) production for the self-supplying of the farming system (iii) production to sell for earning cash income. This function of production is studied, in economic terms, in the set of time of one year.

The productions are assessed, in volume or monetary terms, over one year average or on the average of several years. The difficulties for assessing the perennial plants come from three factors. Firstly, the great variability of the productions each year makes difficult the use of the average. Secondly, the evolution of the production, on the plant life cycle, removes also relevance with the use of annual average. Finally average is not relevant for tree because of the cyclic character of a population of trees having the same age: the trees are planted the same year, they are exploited during the same period of time and they are cut and then replanted the same year. It is possible to postpone, for several months or years, the exploitation of certain products which can remain several years on the perennial plants (wood, barks, sap, gum, resin...) without deteriorating. This characteristic makes it possible to the families to provide for patrimonial functions.

During its cycle of life, a family must assume fluctuations of the level of its income and its consumption. The families keep a part of their incomes or their productions to constitute an annual saving. The accumulation of the saving over several years constitutes the inheritance. Some of these fluctuations are foreseeable and the family prepares them: school fees, the children's marriage, house building for oneself or one's children. The retirement also forces to save means of subsistence since the activities stopping will limit the production of goods or incomes. Other events, requiring a surplus of money, are highly likely to occur, during a life, without being able to determine the date of them: diseases, bad harvests, the replacement of the farm equipment, the purchase of animals. Most of the time, the families save on physical and durable goods like the animals, gold and the trees especially in the countries or the areas where the banking structures are non-existent or defective. These durable goods constitute the individual and family inheritance.

The strategies which use these durable goods to face the irregular needs, current in a life but non foreseeable in time, are patrimonial strategies of smoothing of consumption (see Table 1 as an illustration).

Several types of patrimonial functions are identifiable:

(i) inheritance of cash-flow (e.g. for the purchase of the inputs for the farm)
(ii) inheritance of precaution (e.g. in case of disease)
(iii) inheritance dedicated to events (e.g. for the marriages or the funeral)
(iv) inheritance of cycle of life (for the retirement)
(v) inheritance of transmission (e.g. to bequeath a heritage to the children).

Rural families' objectives and kinship

Economic objectives

To identify the two economic functions that are the production and accumulation, the "family-farming system" can be modeled as a system including two compartments: (i) the farming system, where is held the agricultural productive activity), (ii) the family with its consumption of goods, its projects and its objectives.

Between the two compartments, various exchanges take place: (i) agricultural family work, (ii) subsistence farming, (iii) income and saving.

Flows between the two compartments are as many goods and services which do not go trough the market. The “family-farming system” management leads to arbitrations.
In the family compartment, the arbitrations are: (i) consumption / saving and(ii) work / leisure.
In the farming-system compartment the arbitrations are: (i) self-supplying / selling / storing of the products, (ii) type of the productions, (iii) level and type of the investments.
The arbitrations between the two compartments are: (i) assignment of the saving in nonproductive inheritance (money, gold, and jewels), (ii) assignment of the saving in productive investment: either agricultural or not, (iii) allocation or not of a credit and its amount. However, in most of the tropical rural societies whose kinships are based on lineage system, the farming system of a family cannot be easily identified. Indeed, the decision-making centers relating to the consumption, the production and the accumulation might be separate.

Multiplicity of the objectives
The social and economic objectives are plural and can be contradictory from one family to another, from a member to another one within the same family. One person can also have contradictory objectives not only at various periods of his/her life but also within a period of his/her life according to the activities of the moment and people who share this activity. The principal most current objectives of the rural populations are: the production of self-subsistence, the production for marketing, the production of extra-agricultural incomes, the regularity in intra annual incomes, security of inter annual incomes, the diversification of the activities, the social status, social cohesion, autonomy, rights tenure security...

Communities and kinship
Family is a relevant key concept in the majority of the human societies of the world. Nevertheless its organization and its functioning vary. The family can organize itself on a nuclear or extended family model. The extended families can have a more or less broad base either of proximity of relationship (a patriarch and all its descendants alive), or of lineage (all descendants of an ancestor already deceased and known) or of clannish type (all descendants of an ancestor already deceased but unknown). In a lineage, people know their common ancestor’s name while in a clan, people know they have a common ancestor but they do not know his/her name. The families can also vary their organization: they can daily have a nuclear base but lineage base for certain events (marriage) or for specific decisions (rights tenure) (See table 2/A). The families are not a unit fixed forever not even at every period. The individuals are engaged in communities of four types: production, consumption, accumulation and residence. The members of the same family share only seldom the four types of community. Thus it is necessary to identify, beyond the family structure, this level of organization to understand the practices and the strategies of the farmers (Table 2/B). The first three communities (production, consumption, accumulation) are units with economic purpose what is not the case of the community of residence.
It is essential to identify the three types of economic units and their combination to analyze the farming system. This is particularly true for the perennial species from their diversified biological characteristics seen higher which enable them to fill of the functions of productions and the multiple patrimonial functions sometimes in the same place. Thus if, at first glance, the same space (field) and all its products seem to belong to a whole family, an analysis breaking up, on the one hand, the economic units and, on the other hand, distinguishing the functions of productions and the patrimonial functions filled by the farming system shows that this simplification is a trap (Table 2).

Tenure Rights, complex but necessary and not so difficult to understand Agroforestry systems

"The Law is more what the citizens make of it than what the lawyers say of it."[1] (Le Roy, 1999)

Tenure rights are more complex than the Law first wrote it.

To achieve their objectives, the stakeholders use the resources to which they may have access. This access depends on the tenure rights they have. It is common to admit that property of the land gives the property and thus the rights enjoyment of the tree and consequently of these products. But this corresponds especially to Western vision and laws. Already the concept of property is quite relative all over the world. Moreover, it is not rare that the right on the land does not induce the right on the tree which it carries. The tenure of a tree is not similar to the tenure of its land (Saïd and Sibelet, 2004).

And even in France where the land tenure seem on the one hand simple (share-cropping, hiring, property) and on the other hand to induce the rights of the immovable goods that this land sustains (house, tree) there exist nuances of size. The land in property is supposed to give "*usus et abusus"* rights to a land owner; it means that the owner can do what he wants of his land with the condition of respecting law. So this condition limits directly the rights. And that is increasingly true with the environmental laws which, for example, force the owner to limit the polluting effects of the agricultural or industrial inputs and outputs.

Beyond these restrictions of the law, for ages, for social reasons, French owners let other people collect tree products or non wood forest products either because they are very specific in terms of collecting or for symbolic reasons like mushrooms (Leroy et al., 2004) or in specific time of the year, after harvesting, this is the gleaning right (Degrully, 1912).

A matrix easy to use for analyzing complexity

Considering their own observations on the complexity of the tenure rights, especially in Africa where they have worked more, Le Roy *et al.* (1996) took as a starting point Shlager and Ostrom (1992) results. Le Roy and his colleagues built a model in the form of matrix which makes it possible to index in columns the range of the tenure rights and in line the various modes of the stakeholders' joint management. Progressively with their research, the authors clarified that what call gathered before in the term of land tenure should be distinguished into space tenure and resource tenure (Le Roy, 1999). Concerning the tree resources this dichotomy made it possible to create the concept of tree tenure and to use its operational character (Saïd and Sibelet, 2004). The tenure rights matrix is a simple operational tool which allows analyzing complexity in time and space. It makes it possible to consider the modes of management which vary according to the type of collective or individual stakeholders considered. The tenure rights theory recognizes the complementary activities of the agrarian systems. It is appropriate particularly for the analysis of Agroforestry systems. Indeed, the matrix makes it possible to distinguish the rights of access to the space which carries the tree and the rights of access to the resources i.e. the products, the services, the physical inheritance and the symbolic inheritance provided by the tree (Table 3).

Tenure rights evolving under stakeholders' dynamics

The resource value increase can lead to new tenure rights and management practices: for example, in the forest district of Guinea, the increase of the value of red oil led to (i) the partial appropriation of the oil palm trees bunches and (ii) the set of a period of banning harvesting (Madelaine, 2005).

[1] Personal translation.

Using this matrix (Table 4) and crossing with table 1 and 2 allowed us to examine the equity in access rights and the stake of tenure rights (Table 4).
In the case of Indonesia, the inheritance transmission system seems more profitable to the eldest brother of the family because he receives more lands. But, in fact the youngest have more freedom and so more possibilities to develop new agricultural activities or new business. The eldest brother must assume o lot of social duties and cannot
This shows that the tenure rights have to be compared and analyzed in the whole system they belong and in a dynamic way (historic study, recent evolution and supposed next evolution).

Conclusion

Combining the use of the tools of the system approach, those of kinship and the use of the matrix of the land controls, we can identify and analyze the stakes related to the access rights of the trees and their products in economic and social terms.
The recognition of the diversity of the production functions and of the patrimonial functions helps the development projects to better answer the multiple objectives of the stakeholders, in particular via the Agroforestry systems which offer, from their perennial and various natures, major assets.

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Table 1: Illustration of type of inheritance fulfilled by tree products

Country Type of inheritance	Benin	Cameroon	Ivory Coast	Indonesia
Cash-flow	X	Citrus Cocoa	*Parkia biglobosa*, *Vitellaria paradoxa*, *Anacardium occidentale* (Cotton)	Damar Cloves = *Eugenia caryophyllus* *Coffee*
Precaution	X	X	*Parkia biglobosa*	DurianX
Dedicated to events	X	X	*Anacardium occidentale*	Non identifiedX
Cycle of life	Cashew = *Anacardium occidentale*	Citrus Cocoa	*Parkia biglobosa*, *Vitellaria paradoxa*	Non identified
Transmission	X	Cocoa	*Parkia biglobosa* *Faidherbia albida*	Damar

X means various products contribute to the function
Citrus indicates the specific tree that contribute to the function

Table 2: Social organization features (power/inheritance transmission)

Country	Benin	Cameroon	Ivory Coast	Indonesia
A) Main factors giving people power on tenure rights	Ethnic group + founder lineage + date of arrival in the region	Gender + age	Gender + rank in the family (eldest/youngest)	Gender + rank in the family (eldest/youngest)
B) Main type of inheritance transmission	Patrilineal	Patrilineal	Matrilineal	Patrilineal

Table 3: Tenure rights matrix (Le Roy et al., 1996, translated by A. Karsenty)

Type of appropriation *Method of Joint-management*	Undifferentiated Control *(thing)* ***Right of access***	Priority Control *(Asset)* ***Right of access and extraction***	Specialized Control *(Occupancy)* ***Right of access, extraction and management***	Exclusive Control *(Functional Property)* ***Right of access, extraction, management and exclusion***	Absolute and Exclusive Control *(Ownership)* ***Right of « use and dispose », thus to alienate***
A) Public					
B) External-internal					
C) Internal					
D) Internal					
E) Private					

Table 4: Tenure rights in terms of equity (A) and stakes (B)

Country	Benin	Cameroon	Ivory Coast	Indonesia
A) Equity in access right	Unequal but changing for more equity	Unequal and linked to inheritance transmission	It looks unequal but in fact redistribution of goods	It looks unequal but in fact it exists compensation
B) Stake of the tenure rights	<u>Identity</u>: The ethnic groups who arrived recently need to get land and tree access to be recognized <u>Economic</u>: Cashew can give 24 time more in money than cotton	<u>Economic</u>: Citrus gives income to everybody <u>Social</u>: The citrus income help the people without land	<u>Identity</u>: Allowance to collect fruit depend on the relationships <u>Economic</u>: % of collector's incomes feed backed to the owners. *Parkia biglobosa*: 90% *Vitellaria paradox*: 50% *Anacardium occidentale*: 100%	<u>Economic</u>: The eldest brother inherits more goods. <u>Social</u>: But the youngest brothers have a relative social freedom that facilitate his capacity for developing business